HEENA DUGGAL

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EDUCATION

PANJAB UNIVERSITY, INDIA

Ph.D. in Atomic Physics **2016**
Thesis titled: *"Investigation of inner shell vacancy decay processes through X-ray emission and analytical applications using XRF technique"*

Master of Philosophy in Physics **2009**
1st Rank in University (Gold Medalist), GPA-4.0

GURU NANAK DEV UNIVERSITY, INDIA

Master of Science in Physics **2007**
First Division, 2nd Rank in University, GPA-4.0

Bachelor of Science in Physics **2005**
First Division, Distinction in Mathematics, GPA-4.0

CAREER HIGHLIGHTS

- ☑ 8 years of Research Experience in Atomic & Radiation Physics.
- ☑ Fluent in EDXRF, WDXRF, XRD, SEM, TEM, PIXE/PIGE and XAFS techniques.
- ☑ 7 years Teaching Experience at under-graduate and post-graduate levels.
- ☑ Experience in handling radiation sources: radioisotope, X-ray tube and Synchrotron source.
- ☑ Well conversant with computer software required for the aforesaid techniques.

HONORS AND AWARDS

- Awarded Meritorious Fellowship by University Grants Commission (UGC), Government of India, for pursuing Ph.D. from March 2014 to May 2016.
- Qualified the National Eligibility Test (NET) exam for Teaching and Research fellowships conducted jointly by Council of Scientific Industrial Research (CSIR) and UGC, India in December 2008.
- Qualified the Graduate Aptitude Test in Engineering (GATE) in 2009.
- Awarded Gold Medal for achieving first rank in University in Master's of Philosophy in Physics at Panjab University, Chandigarh in 2009.
- Awarded Merit Scholarship for achieving second rank in University during Master's of Science in Physics at Department of Physics, Guru Nanak Dev University, India in 2007.
- Awarded Merit Scholarship and Gold Medal for academic distinction Mathematics in Bachelor's of Science in Physics at the Department of Physics, Guru Nanak Dev University, India in 2005.

RESEARCH EXPERIENCE

Doctoral Research (2010 - 2016)
Panjab University, India

- X-ray spectroscopy - Photon-atom interaction studies
  + Measurement of inner-shell vacancy decay parameters
  + Measurements of X-ray fluorescence cross-sections
  + Fluorescence yields and Vacancy transfer probabilities measurements
  + Rayleigh and Compton scattering cross sections
  + Resonant Raman scattering measurements
- XANES spectroscopic measurements using Synchrotron sources
- Elemental analysis and phase identification of:
  + Traditional Indian Ayurvedic medicines of the Ras family
  + Fertilizers
  + Flyash and coal
  + Water and soil samples
- Configure EDXRF/WDXRF set ups based on radioactive sources and X-ray tube exciters depending upon the experiment to be performed.
- Radiation sources used: Radioactive source (Point and annular), X-ray tube, X-ray tube with secondary exciter and Synchrotron source at INDUS 2, Raja Raman Centre of Advance Technology, Indore, India

Master of Philosophy in Physics Dissertation (2008 - 2010)
Panjab University, India

- Photon-atom interactions in X-ray energy region
  + Measurement of inner-shell vacancy decay parameters
  + Resonant Raman scattering measurements.

WORK EXPERIENCE

ASSISTANT PROFESSOR (TENURE)–Department of Physics, Panjab University, Chandigarh, India
[*January 2016 – June 2016*]

- Taught coursework for Optics and Modern Physics and Waves and Vibrations for the program Bachelor's of Science in Physics.
- Assisted in the Physics Laboratory Courses for the Master's of Science and supervised M.Sc. Project work in the Physics program.
- Assisted students in the research projects.

RESEARCH ASSISTANT – Department of Physics, Panjab University, Chandigarh, India
[*March 2014 - May 2016*]

- Pursued research in experimental X-ray Spectroscopy.
- Involved in setting up of EDXRF/WDXRF set ups based on radioactive sources and X-ray tube exciters.
- Skilled in using Peakfit, Gupix and Matlab for data analysis.

ASSISTANT PROFESSOR – DAV College, Chandigarh, India
[*July 2012 - February 2014*]

- Taught coursework for Mathematical Physics, Nuclear Physics and Physics Laboratory for the program Master's of Science in Physics.
- Deputy Superintendent at the Conduct Branch of Post-Graduate Examinations.
- Actively involved in drafting the curricula for new courses in the programs: B.Sc. and M.Sc. in Physics.

[*July 2009 - February 2012*]

- Taught coursework and labs for the courses Mathematical Physics and Particle Physics for the program Master's of Science.

- Member of Secrecy Committee of the Conduct Branch of Examinations and of Purchase Committee

[*July 2007 - March 2008*]

- Taught coursework and labs for the course Mechanics for the program Bachelor's in Science and the course Mathematical Physics for the program Master's of Science.
- Member of Secrecy Committee of the Conduct Branch of Examinations and of Purchase Committee

PROFICIENT IN

- EDXRF, WDXRF Techniques
- XRD
- XAFS (EXAFS and XANES)
- SEM/TEM
- UV/Vis, FTIR and RAMAN Spectroscopy
- Thin Film Coating Techniques

COMPUTER SKILLS

- Programming Languages - C, C++ and FORTRAN 77
- Data Analysis and Graphing Software - Peakfit, Gupix and OriginPro
- Microsoft Office

SOFT SKILLS

- Proposal writing
- Team work
- Time management

PUBLICATIONS

In Process

- Heena Duggal, Gurjot Singh, Sanjeev Kumar and D. Mehta, "*Elemental analysis and chemical phase identification of traditional Ayurvedic medicines of Ras family*", in communication with JAMA (2017).
- Heena Duggal, S. Gautam, S. N. Jha and D. Mehta, "*XANES spectroscopic studies at L_3 edge of $_{79}$Au in its various chemical form* ", submitted to EPJD (2017).
- Heena Duggal, Gurjot Singh, Gurjeet Singh, Sanjeev Kumar, J. S. Shahi and D. Mehta, "*Differential scattering cross section measurements for 5.895 keV photons from various polymers*", to be submitted to Phys. Rev. A (2017).

Peer Reviewed Journals

- Heena Duggal, Veena Sharma, Sanjeev Kumar and D. Mehta, "*L_i subshell (i = 1-3) radiative vacancy decay following photoionization and RRS processes in elements with Z= 34-51*", communicated to Phys. Rev. A (2017).
- Khushboo, S. R. Abhilash, G. R. Umapathy, H. Duggal, D. Kabiraj, S. Mandal,"*Engineering strain to achieve stable ^{92}Zr targets on carbon backing*", accepted in Vacuum.

- T. Banerjee, S.R. Abhilash, D. Kabiraj, S. Ojha, G.R. Umapathy, M. Shareef, P.V. Laveen, H. Duggal, R.U. Amarnadh, J. Gehlot, S. Nath, D. Mehta," *Fabrication of thin targets for nuclear reaction studies at IUAC*", Vacuum 144 (2017) 190.
- Arun Upmanyu, Gurjot Singh, Heena Duggal, H.S. Kainth, Atul Bhalla, Sanjeev Kumar, "Measurement of large angle Rayleigh scattering cross sections for 39.5, 40.1 and 45.4 keV photons in elements with $26 \leq Z \leq 83$ ", Applied Radiation and Isotopes 128 (2017) 125.
- Gurjaspreet Singh, Sunita Rania, Aanchal Arora, Sanchita, Heena Duggal, "*Organic-inorganic nano-hybrid decorated by copper (II) incarceration: A versatile catalytic assembly for the swift reduction of aromatic nitro and dye compounds*", accepted in J. of Molecular Catalysis (2017).
- Meenu Thakur, R. Dubey, Abhilash S. R, B. R. Behera, D. Kabiraj, Sunil Ohja, Heena Duggal, B. P. Mohanty, "*Fabrication and characterization of carbon-backed thin ^{208}Pb targets for experiments with NAND facility*", MethodsX (2016).
- Atul Bhalla, Heena Duggal, Navjeet Sharma, J. S. Shahi and D. Mehta, "*Investigations on nuclear investigation system using Data Acceptance tests"*, Elixir Nuclear & Radiation Phys., 98 (2016) 42482.
- Heena Duggal, Atul Bhalla, Sanjeev Kumar, J.S. Shahi and D. Mehta, "*Elemental analysis of condiments, food additives and edible salts using x-ray Fluorescence technique*", Int. J. Pharm. Sci. Rev. Res., 35 (2015) 126.
- Aman Rohilla, C. K.Gupta, Tapan Rajbongshi, R. P. Singh, Sunil Ojha, Heena Duggal, D. Mehta, S. K. Chamoli, "*Fabrication of enriched $^{174}Yb_2O_3$ thin targets on carbon and tantalum backings"*, Nucl. Instrum. Meth. A 797 (2015) 230.
- Atul Bhalla, Heena Duggal, J. S. Shahi, Bimal Rai and D. Mehta, "*A study of toxicity of selenium, uranium and bromine in ground water of Punjab state of India"*, J. Wat. Res. 136 (2014) 278.
- Atul Bhalla, Heena Duggal, J. S. Shahi, Bimal Rai and D. Mehta, "*WDXRF/FTIR/UV-Vis based spectroscopic studies of Asphaltum (Shilajeet) for elemental profiling and its metal tagging capability from polluted waters*", Journal of Physics, Photon 108 (2014) 18.
- Atul Bhalla, Heena Duggal, Gurjeet Singh, J. S. Shahi and D. Mehta, "*A study of uranium depleting capability of earthenware vessels from drinking water using X-Ray Fluorescence technique*", Int. J. New. Inn. 2 (2013) 482.
- Atul Bhalla, Heena Duggal, J. S. Shahi and D. Mehta," *Growing water footprint in Punjab - A Crisis: Causes and Cures*", J. Po. Sc. 8 (2012) 90.

Conferences, Symposia & Workshops

- *"Measurements of Scattering Cross Section for 5.895 keV Photons in various Polymers".* Heena Duggal, Gurjeet Singh, Gurjot Singh, Atul Bhalla, S. Kumar, J. S. Shahi and D. Mehta, proceedings of ICXRNO, London (2014).
- *"Measurements of elastic and inelastic scattering cross section for 5.895 keV photon from various polymers".* Heena Duggal, Gurjeet Singh, Gurjot Singh, Atul Bhalla, S. Kumar, J. S. Shahi and D. Mehta, proceedings of 8th Chandigarh Science Congress, India (2014).
- *"Measurements of total scattering cross section for 5.895 keV photons from various polymers in liquid phase".* Heena Duggal, Atul Bhalla, S. Kumar, J. S. Shahi and D. Mehta, National conference, proceedings of Science Colloquium, Emerging trends in basic and applied sciences, DAV College, Jalandhar, India (2014).
- *"Contribution of Di-ammonium phosphate fertilizer to ground water contamination".* Gurjeet Singh, Heena Duggal, J. S. Shahi and D.Mehta, proceedings of 8th Chandigarh Science Congress, India (2014).
- *"Impact of ground water contamination and way forward in Punjab for groundwater development".* Atul Bhalla, Heena Duggal, J. S. Shahi and D. Mehta, presented in workshop, "Sustainable Development Of Ground Water Resources In The States Of Punjab And Haryana", Central Ground Water Board, Ministry of Water Resources, Govt. of India and published in the proceedings (2013).
- *"Elemental analysis of Di-Ammonium Phosphate fertilizer using X-ray fluorescence analytical technique".* Gurjeet Singh, Heena Duggal, Gurjot Singh, Vishal Gupta and D. Mehta, proceedings of 7th Chandigarh Science congress, India (2013).
- *"Alignment of L_3 subshell vacancy states in $_{80}Pb$, $_{90}Th$ and $_{92}U$ following selective photoioization and effect of external magnetic fields".* Gurjeet Singh, Vishal Gupta, Heena Duggal, Gurjot Singh and D. Mehta, proceedings of 7th Chandigarh Science congress, India (2013).

- *"Elemental analysis of gourmet condiment salts using X-ray fluorescence analytical technique".* Atul Bhalla, Heena Duggal, Tejbir Singh, J.S. Shahi and D. Mehta, proceedings of International Conference at Chemical Constellation Cheminar at NIT, Jalandhar (Punjab), India (2012)
- *"Growing water footprints in Punjab-20 points for solving the crisis".* Atul Bhalla, Heena Duggal, J. S. Shahi and D. Mehta, proceedings of National Conference on Material Science: Applications in Energy and Environment at DAV College, Jalandhar, India (2012).
- *"Earthenware Ceramic Pottery: A Potential Remedial Tool for Decontaminating Drinking water".* Atul Bhalla, Heena Duggal, Gurjeet Singh, J.S. Shahi and D. Mehta presented at 6th Chandigarh Science congress, India (2012).
- *"Measurement of M x-rays production cross-sections for elements with $77 \leq Z \leq 92$ at 5.96 keV incident photon energy"*. Heena Duggal, M. Alrakabi, Veena Sharma, Sanjeev Kumar and D. Mehta, proceedings of National conference on Advanced Material and Radiation Physics at Sant Longowal Institute of Engineering and Technology, Sangrur, India (AMRP-2011).
- *"Measurement of $KL_{2,3}$ radiative resonant raman scattering in $_{24}Cr$ for the unpolarised Mn Kα x-rays".* Sanjeev Kumar, Veena Sharma, Heena Duggal, N. Singh and D. Mehta, proceedings of National conference on Advanced Material and Radiation Physics at Sant Longowal Institute of Engineering and Technology, Sangrur, India (AMRP-2011).
- *"Thickness measurement of carbon nanotubes (CNT) films deposits on Si/Glass substrate using EDXRF Technique".* Sanjeev Kumar, Heena Duggal, J. S. Shahi, D. Mehta, proceedings of National Symposium on Radiation Physics and Nanomaterials (NSRPN-11) at Punjabi University, Patiala, India.
- *"Elemental analysis of industrial waste water drained to Sutlej river and ground water from North-east region in Punjab".* Atul Bhalla, Gurjeet Singh, M. Alrakabi, Ranjit Singh, Heena Duggal, D. Mehta and N. Singh, proceedings of National Symposium on Radiation Physics and Nanomaterials (NSRPN-11), India.
- *"Elemental analysis of water using EDXRF technique - need for chemical speciation of Br".* Atul Bhalla, Gurjeet Singh, Heena Duggal, M. Alrakabi, J. S. Shahi and D. Mehta, proceedings of 3rd International Conference on Climate change, Forest Resource and Environment at University of Kerala, Thiruvananthapuram (ICCFRE-2011), India.
- *"Characterisation of some nanomaterial samples using Non-Destructive EDXRF technique".* Atul Bhalla, Heena Duggal, proceedings of National Conference on Material Science and Technology: Emerging Trends (NCMST-2010), India.